REMARKS

Claims 1-113 are pending in the application, of which claims 31-59 stand withdrawn from consideration. All claims under consideration in the application stand rejected under 35 U.S.C. § 103(a). In view of the foregoing amendments and the following remarks, applicants request reconsideration of the rejection of the claims and re-examination of the application.

Restriction Requirement. Applicants hereby affirm the election to prosecute the invention of Group I, claims 1-30 and 60-113. Applicants wish to reassert the traversal presented by applicants' attorney, James A. Cairns, when making the provisional election by telephone with Examiner Michl on November 8, 1997. Applicants believe that the subject matter of the withdrawn claims 31-59 is sufficiently closely related to the claims of Group I to warrant examination in this application.

Claims Rejection Under 35 U.S.C. § 103(a). Applicants respectfully traverse the claim rejections presented in the Office Action under 35 U.S.C. § 103(a). The present invention involves a significant advance in the technology of elastomer composites. It has been well known for many years, that carbon black and other fillers can be mixed with natural rubber or other elastomers. Dry mixing techniques are known, in which the mechanical mixing/grinding of an elastomer with the filler causes coagulation of the elastomer. Unfortunately, it also causes degradation of the elastomer, for example, undesirably reducing the molecular weight of natural rubber. Also, such dry mixing techniques have simply been unable to achieve excellent dispersion uniformity of the carbon black or other filler throughout the elastomer, particularly if unacceptable molecular weight degradation is to be avoided. Thus, it has long been desired to achieve better filler distribution in elastomer without unacceptable degradation of the elastomer.

Wet mixing techniques have, also been known. A fluid slurry of particulate filler or the like is mixed or blended with a fluid elastomer latex, followed by treatment with a coagulant fluid, typically an acid or salt solution. The present specification discusses the serious disadvantages of such wet mixing methods, including the difficulty and cost of handling the salt and acid solutions, as well as environmental issues presented by disposal of effluent fluids.

The present invention achieves excellent filler distribution without suffering the unacceptable elastomer degredation of the prior known methods, and without the need to use an acid or salt solution or other coagulant. Energy intensive dry mixing methods are avoided, along with their adverse degredation of the elastomer, and the cost and complexity of the prior known wet mixing techniques using coagulant solutions are avoided, and yet better elastomer composite products can be produced than was provided by those prior known methods.

As now discussed in more detail, none of the patents cited by the Examiner in support of the claim rejections teaches or suggests the present invention. None of them provide the outstanding advantages of the present invention.

Claims 1-3, 5-13, 16-28, 60, 61, 63, 64, 66 and 113 are rejected under 35 U.S.C. §103(a) as being unpatentable over Hertel et al (U.S. 4,103,074) or Gurak et al (U.S. 4,302,377) or Güurak et al (U.S. 4,303,569) or Jiroumaru et al (U.S. 4,446,309), each in view of either Neubert (U.S. 3,887,532) or Davidson et al (U.S. 4,025,711), and further in view of either Kobayashi et al (U.S. 4,124,550) or Horiuchi et al (U.S. 5,047,287) or Tomizawa et al (U.S. 5,658,657). Noting that applicants' claims are directed to a method of coagulating rubber latex with particulate filler fluid, or to a composition of rubber and filler, Examiner Michl asserts that Hertel et al, Gurak et al '377, Güurak et al '569 and Jiroumaru et al all are directed to methods of coagulating rubber latex.

These cited patents do, indeed, disclose methods of coagulating rubber latex, but there the similarity ends. Hertel et al is not directed to a method of producing "elastomer composite," because it does not employ a particulate filler. Rather, Hertel et al uses coagulant to coagulate the elastomer, such as an acid solution or a salt solution. The coagulant and latex are mixed in a screw-type extruder in which the latex and coagulant are mixed and mechanically worked. Most fundamentally Hertel et al fails to support the claim rejection, because it fails to teach or suggest particulate filler fluid mixed with an elastomer latex sufficiently energetically to mix with and coagulate the latex without the need of acid or salt solution or other coagulating agent.

Gurak et al '377 is similarly deficient. Here, again, the teaching is directed to use of a coagulant such as acid or salt (see, for example, Col. 3, lines 4-20). Furthermore, Gurak et al is

deficient in that it does not produce an "elastomer composite." That is, Gurak et al does not discuss elastomer with particulate filler. Certainly, it fails to teach or suggest particulate filler in a fluid mixed with an elastomer latex sufficiently energetically to mix with and coagulate the latex without the need of acid or salt solution or other coagulating agent. The disclosure of Güurak et al '569 is closely related to that of Gurak et al '377, and is similarly deficient.

The Jiroumaru et al patent is deficient for the same reasons. It does not form an elastomer composite as that term is used in the present claims, because it fails to teach the addition of carbon black or other particulate filler to an elastomer. Furthermore, it does not coagulate an elastomer latex by sufficiently energetic feed of a particulate filler fluid. Rather, Jiroumaru et al is merely an example of the prior known use of an acid or salt solution coagulant. The critical feature of Jiroumaru et al seems to be the use of a "coagulator having agitating blades" to mix a polymer latex with a coagulant solution of inorganic salt or acid or an organic acid solution or a hydrophilic polar solvent. (See, for example, Col. 1, lines 15-22; Col. 2, lines 21-27.)

For the same reasons, none of the primary citations teach or suggest the claimed subject matter of product-by-process claims 64 and 66. That is, the cited patents fail to teach the process limitation of claims 64 and 66. Moreover, as explained in the specification of the present application (see, e.g., page 7, lines 21-23; page 10, lines 17-20; page 121, lines 1-9), prior known methods, such as those taught by the cited patents, did not achieve the present invention's highly advantageous macro-dispersion of particulate filer in the elastomer. Claim 64 defines the claimed elastomer as having macro-dispersion less then 0.2% undisbursed area. Compare, for example, the "Dispersion Index" values in the recently issued Bohn et al patent. Bohm et al note the industry's desire to achieve a high dispersion index or "DI" value (corresponding to 100 minus the D% values of the present invention), e.g., at Col. 7, lines 34-42, and speak of achieving a dispersion index which "increased markedly" (Col. 8, line 18) from 76.5 to 98.2. (See Table III of Bohm et al.) But Bohm et al's 98.2 value corresponds to D(5) = 1.8%. In comparison, D(%) = 0.2% is called out in present claim 64; the present invention is an order-of-magnitude better than the dispersion obtained by Bohm et al. The dispersion index

values called out in the other examples of Bohm et al are worse, and there appears to be nothing better in any of the other cited patents.

Thus, the elastomer composites of rejected claims 64 and 66 are seen to in fact, achieve significantly better macro-dispersion, answering a well recognized, long felt need in the rubber industry.

These fundamental deficiencies of the primary citations are not cured by the secondary citations. The Neubert patent is asserted to disclose a method of coagulating rubber latex using aluminum sulphate, and the Examiner takes the position that aluminum sulphate qualifies as "filler" within the meaning of that term in the present claims. To the contrary, aluminum sulphate is not a "filler" as used in the present claims; aluminum sulphate is water soluble. In fact, Neubert teaches away from the present invention. At Col. 1, lines 30-36, Neubert teaches that rubber must first be coagulated before carbon black can be mixed into the rubber. Neubert mentions aluminum sulphate as one of several alternative materials to be used in a "coagulation solution". Clearly, Neubert's call for "a coagulation solution" makes clear that aluminum sulphate is merely a water soluble coagulation agent and not a particulate filler in the resulting rubber. Similarly, secondary citation Davidson et al fails to cure the deficiencies of the primary citations. Davidson et al emphasizes its avoidance of salt as a coagulation agent, coagulating the latex instead with traditional acid plus a lignin. Davidson et al states that "The process of the present invention most preferably uses aqueous solutions of sodium lignate." (Col. 2, lines 32-33.) Here, again, the teaching is merely of traditional rubber coagulation using, in this case, acid with the addition of a lignate, preferably an aqueous solution of sodium lignate. This teaching falls far short of curing the fundamental deficiencies of the primary citations, as discussed above, specifically, the lack of any teaching or suggestion of a coagulation method wherein a particulate filler fluid is fed to an elastomer latex sufficiently energetically to coagulate the latex without using a coagulant as in the prior art, e.g., acid and/or salt solution coagulants.

The tertiary citations, Kobayashi et al, Horiuchi et al and Tomizawa et al also fail to cure the fundamental deficiencies of the primary and secondary citations, discussed above. Kobayashi et al has no teaching directed to mixing a particulate filler fluid with an elastomeric latex fluid. It does not teach or suggest the use of particulate filler to coagulate an elastomer

latex. Horiuchi et al also does not coagulate an elastomer latex with a particulate filler. Rather Horiuchi et al coagulates an adhesive material with acid, salt or alcohol coagulent. In Horiuchi et al, also, a fluororubber is blended with carbon black or other ingredients, but not coagulated. Finally, the Tomizawa et al patent teaches kneading a synthetic rubber with carbon black or other filler.

Accordingly, all of these primary, secondary and tertiary citations fail collectively and separately to teach or suggest the present invention. Taken together, in fact, they merely argue persuasively for the status quo, that is, the traditional use of acid or salt solutions or other such coagulants to coagulate an elastomer. None suggests there may be an alternative, better method which produces elastomer composite with previously unachieved levels of carbon black or other filler macro-dispersion. Accordingly, applicants respectfully submit that the rejection is in error and should be withdrawn.

Claims 1-30 and 60-113 are rejected under 35 U.S.C. § 103(a) over Barclay (U.S. 3,108,982) or Thorn (U.S. 3,335,200) or Hagopian et al (U.S. 4,029,633) or Sandstrom (U.S. 4,375,497) or Bohm et al (U.S. 5,599,868) either alone (page 4 of the Office Action) or taken in view of secondary citations Hertel et al or Gurak '377 or Güurak '569 or Jiroumaru et al. The Examiner asserts that Barclay, Thorn, Hagopian et al, Sandstrom and Bohm et al all disclose coagulating rubber latex with aqueous carbon black dispersions. The Examiner candidly admits, however, that none of the cited patents discloses that the mixing of the latex and the carbon black dispersion is sufficiently energetic, as called for in the present claims, to achieve coagulation without the need for a coagulant, such as an acid or salt solution. The Examiner asserts that it would be obvious to one of ordinary skill in the art to coagulate rubber latex with aqueous carbon black dispersion under conditions which are sufficiently energetic to coagulate the rubber in the methods of Barclay, Hagopian et al, Sandstrom or Bohm et al. In support of this conclusion, the Examiner asserts that one of ordinary skill would be motivated to completely coagulate the rubber latex in the method of any of the cited patents. The rejection is respectfully traversed.

Applicants must respectfully disagree that there is any motivation in the cited patents to coagulate rubber latex in accordance with the novel method of the present invention. All of the cited patents expressly teach that they do, in fact, achieve coagulation of the rubber, but in a way

different from the present invention. Each of them teaches the old traditional way of using acid or salt coagulant. Barclay uses "an acidified aqueous dispersion of carbon black" which is mixed with a latex and then subjected to agitating and comminuting action. (Col. 2, lines 31-39). Thorn, similarly, is another example of the prior known use of acid to coagulate. See the sulphuric acid feed to a latex coagulation tank 42 shown in the lower left corner of the drawing of the Thorn patent. Hagopian et al is cited in the present specification. It is yet another example of feeding a pre-mixed - but uncoagulated - carbon black slurry and latex stream into a stream of acid to coagulate the rubber. (See, e.g., Col. 2, line 4-9.) In fact, Hagopian et al arguably teaches away from the present invention. Specifically, Hagopian et al teaches that the creaming operation produces optimum quality if carried out under conditions of low sheer. (Col. 2, lines 30-35.) Sandstrom also mixes an aqueous filler solution with a liquid elastomer latex and, again, does not achieve coagulation except by subsequent addition of a coagulant solution. Specifically, Sandstrom relies on an acid/alum solution as the coagulant. (See, e.g., Col 2, lines 11-13.) Finally, Bohm et al uses typical mechanical mixing to achieve coagulation. (See, for example, Col. 7, lines 13-24.) Bohm et al uses carbon black which has been treated with water, and teaches that liquid is driven off by evaporation during the final mixing step. Hence, Bohm et al is more exemplary of dry mixing techniques well known to the industry. (Col. 7, lines 25-33.)

The secondary citations fail to cure the above discussed fundamental deficiencies of Barclay, Thorn, Hagopian et al, Sandstrom and Bohm et al. The Examiner asserts that it would have been obvious to coagulate rubber latex with aqueous carbon black using the coagulation apparatus and conventional methods shown by Hertel et al or Gurak '377 or Güurak '569 or Jiroumaru et al. This assertion, however, fails to support the rejection of the claims, because whether or not it would have been obvious to coagulate rubber latex with aqueous carbon black using the coagulation apparatus and methods shown by Hertel et al or Gurak '377, or Güurak '569 or Jiroumaru et al does not bear on the patentability of the present invention. The coagulation of rubber latex as in Barclay or Thorn or Hagopian et al or Sandstrom or Bohm et al using the coagulation apparatus and processes taught by Hertel et al or Gurak or Jiroumaru et al is not the present invention. Each of these citations has been discussed above. Each fails to teach or suggest the present invention. Taken together, they still fail to teach or suggest the

present invention and, rather, serve to highlight the entrenched belief by the rubber compounding industry for many, many years that rubber could be coagulated by dry mixing with carbon black or rubber could be wet mixed and then subjected to a separate coagulation step using an aqueous acid or salt solution or other such coagulant solution. None of the references, either alone or together could lead those skilled in the art to the significant advancement embodied by the present invention. Specifically, none teach or suggest that a particulate filler fluid could be fed to a mixing zone sufficiently energetically to coagulate an elastomer latex fluid without needing to resort to an acid or salt solution or other such traditional coagulant.

Accordingly, applicants request that the rejections be withdrawn.

Claims 60-112 are rejected under 35 U.S.C. § 103 (a) over Barclay or Thorn or Hagopian et al or Sandstrom or Bohm et al, each in view of Ohashi et al '088 (U.S., 5,430,988) or Ohashi et al '833 (U.S. 5,516,833) or Probst et al (U.S. 5,639,817). The Ohashi et al and Probst et al patents are cited by the Examiner for their disclosure of compositions comprising rubber and certain particular carbon blacks. The Examiner concludes that it would have been obvious to one of ordinary skill in the art to coagulate rubber latex with an aqueous carbon black dispersion using the particular carbon blacks shown by Ohashi et al '088 or Ohashi et al '833 or Probst et al.

The rejection is respectfully traversed for the reasons discussed above. The fundamental deficiencies of Barclay, Thorn, Hagopian et al, Sandstrom and Bohm et al have been discussed at length above, which discussion is incorporated here by reference. The Ohashi et al '088, Ohashi et al '833 and Probst et al patents failed, either alone or collectively, to cure those fundamental deficiencies.

More specifically, the Ohashi et al '088 patent simply has no teaching directed to any mixing or compounding techniques. Similarly, the Ohashi et al '833 patent has no teaching as to how an elastomer can be compounded with carbon black or other filler. The teaching of Ohashi et al '833 parallels that of Ohashi et al '088 in directing the reader to choosing certain fillers without consideration of the macro-dispersion of such filler within the compound. According,

the patent also provides no useful teaching for curing the fundamental deficiencies of the primary citations.

Finally, the Probst et al patent, like the Ohashi et al patents, simply has no teaching as to how to combine carbon black or other particulate filler with an elastomer. At best Probst can be taken as implying the use of prior known compounding techniques which simply did not produce the elastomer composites defined by the present claims. Accordingly, the rejection is without support and should be withdrawn.

Respectfully submitted,
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I hereby certify that this amendment in response to first office action enclosed herewith is being deposited with the U.S. Postal Service as First Class Mail, postage prepaid, in an envelope addressed to: Assistant Commissioner of Patents and Trademarks, Washington, D.C. 20231 on the date indicated below.

June 8, 1998
Date

Peter D. McDermott